CLAIMS

1. A compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and the salt form is chemically stable and/or the anionic complement does not exhibit reactivity against the antioxidant moiety, the cationic moiety or the linking moiety.

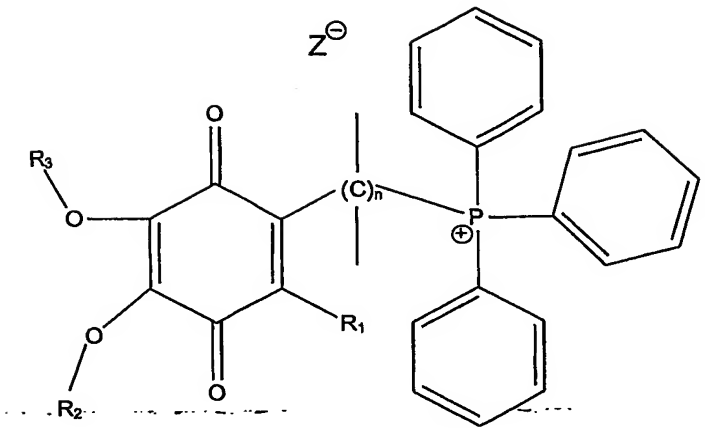
   A stable compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and wherein the anionic complement is not a halogen ion, and the anionic complement is non-nucleophilic and/or the anionic complement does not exhibit reactivity against the cationic moiety, the linking moiety, or the antioxidant moiety.

3. A compound according to claim 1 or 2 wherein the antioxidant moiety is a quinone or a quinol.

4. A compound according to claim 1 or 2 wherein the antioxidant moiety is selected from the group comprising vitamin E and vitamin E derivatives, chain breaking antioxidants, including butylated hydroxyanisole, butylated hydroxytoluene, general radical scavengers including derivatised fullerenes, spin traps including derivatives of 5,5-dimethylpyrroline-*N*-oxide, *tert*-butylnitrosobenzene, *tert*-nitrosobenzene, α-phenyl-*tert*-butylnitrone and related compounds.

5. A compound according to any of claims 1 to 4 wherein the lipophilic cationic moiety is a substituted or an unsubstituted triphenylphosphonium cation.

6. A compound according to claim 5 wherein the compound has the general formula I



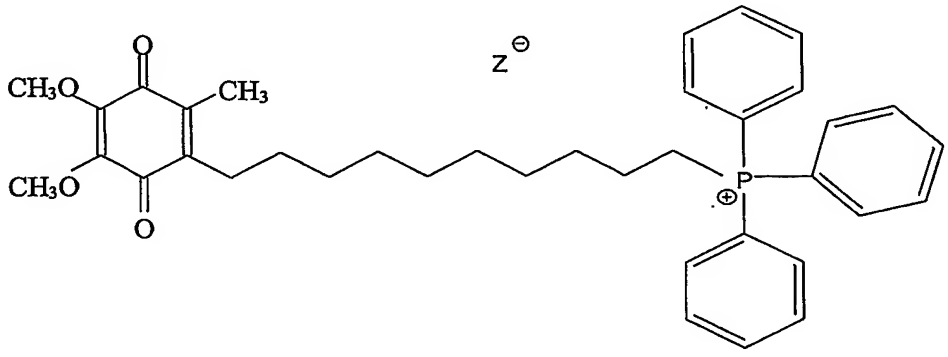
I

and/or its quinol form, wherein R_1, R_2, and R_3, which can be the same or different, are selected from C_1 to C_5 alkyl (optionally substituted) moieties or H, and wherein n is an integer from about 2 to about 20, and wherein Z is a non-reactive anion.

7. A compound according to claim 6 wherein Z is selected from the group consisting of alkyl or aryl sulfonates or nitrates.

8. A compound according to claim 6 or claim 7 wherein C of the (C)n bridge is saturated.

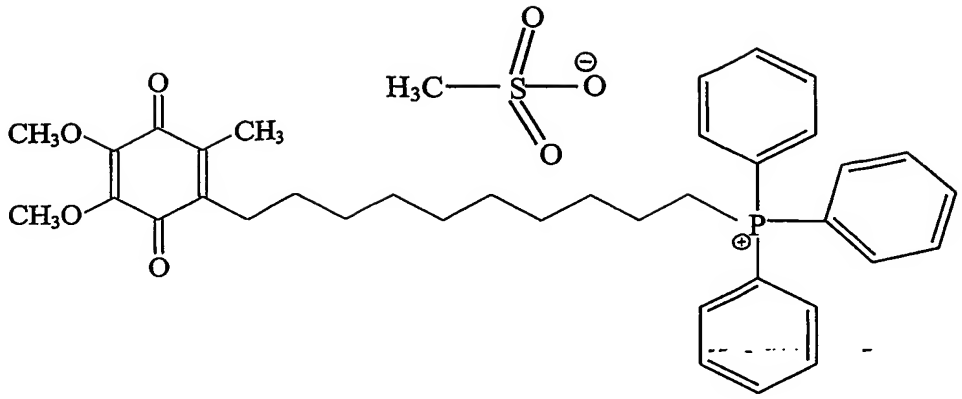
9. A compound according to claim 8 wherein the compound has the formula



II

and/or its quinol form, wherein Z is a non-nucleophilic anion.

10. A compound according to claim 9 wherein the compound has the formula



(III).

11. A pharmaceutical composition comprising or including a compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and the salt form is chemically stable and/or the anionic complement does not exhibit reactivity against the antioxidant moiety, the cationic moiety or the linking moiety.

12. A pharmaceutical composition comprising or including a stable compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and wherein the anionic complement is not a halogen ion, and the anionic complement is non-nucleophilic and/or the anionic complement does not exhibit reactivity against the cationic moiety, the linking moiety, or the antioxidant moiety.

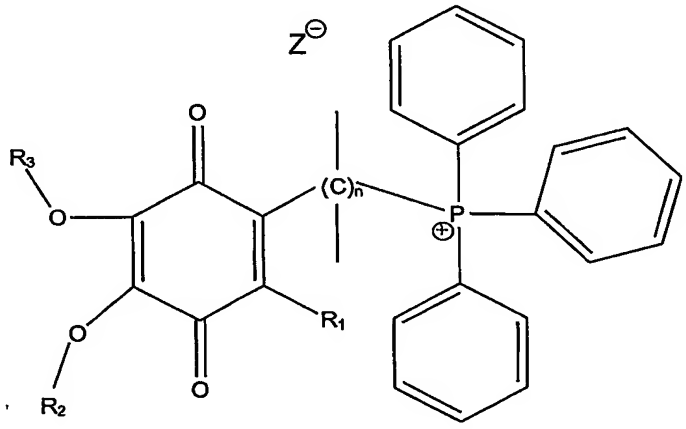
13. A composition according to claim 11 or 12 wherein the antioxidant moiety is a quinone or a quinol.

14. A composition according to claim 11 or 12 wherein the antioxidant moiety is selected from the group comprising vitamin E and vitamin E derivatives,

chain breaking antioxidants, including butylated hydroxyanisole, butylated hydroxytoluene, general radical scavengers including derivatised fullerenes, spin traps including derivatives of 5,5-dimethylpyrroline-*N*-oxide, *tert*-butylnitrosobenzene, *tert*-nitrosobenzene, α-phenyl-*tert*-butylnitrone and related compounds.

15. A composition according to any of claims 11 to 14 wherein the lipophilic cationic moiety is a substituted or an unsubstituted triphenylphosphonium cation.

16. A composition according to claim 15 wherein the compound has the general formula I



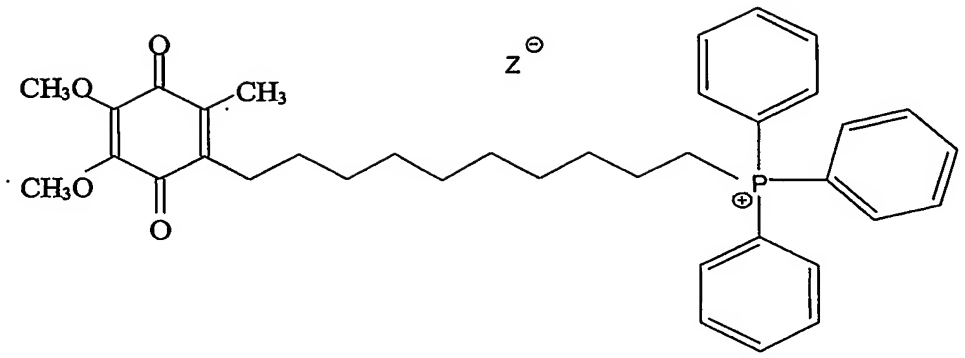
I

and/or its quinol form, wherein R_1, R_2, and R_3, which can be the same or different, are selected from C_1 to C_5 alkyl (optionally substituted) moieties or H, and wherein n is an integer from about 2 to 20, and wherein Z is a non-reactive anion.

17. A composition according to claim 16 wherein Z is selected from the group consisting of alkyl or aryl sulfonates or nitrates.

18. A composition according to claim 16 or claim 17 wherein C of the (C)n bridge is saturated.

19. A composition according to claim 18 wherein the compound has the formula



II

and/or its quinol form, wherein Z is a non-nucleophilic anion.

20. A composition according to any of claims 11 to 19 wherein the composition comprises cyclodextrin.

21. A composition according to claim 20 wherein the molar ratio of compound to cyclodextrin is from about 10:1 to about 1:10.

22. A composition according to claim 21 wherein the molar ratio of compound to cyclodextrin is from about 5:1 to about 1:5.

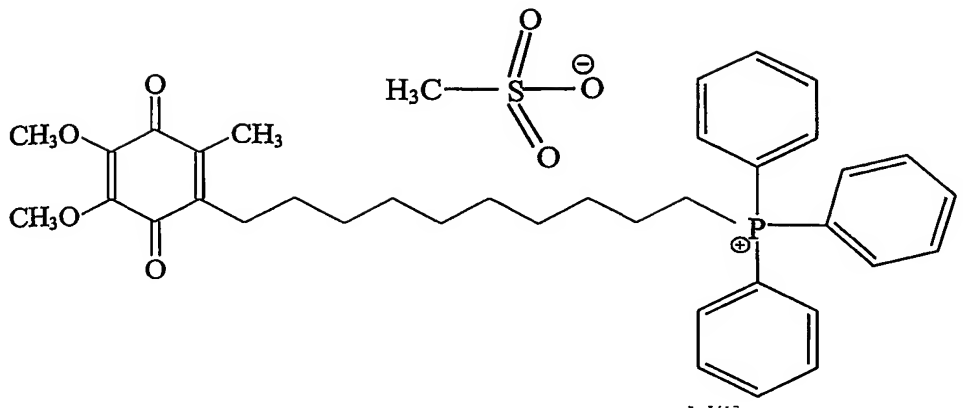
23. A composition according to claim 22 wherein the molar ratio of compound to cyclodextrin is from about 4:1 to about 1:4

24. A composition according to claim 23 wherein the molar ratio of compound to cyclodextrin is from about 2:1 to about 1:2

25. A composition according to claim 24 wherein the molar ratio of compound to cyclodextrin is about 1:1.

26. A composition according to claim 24 wherein the molar ratio of compound to cyclodextrin is about 1:2.

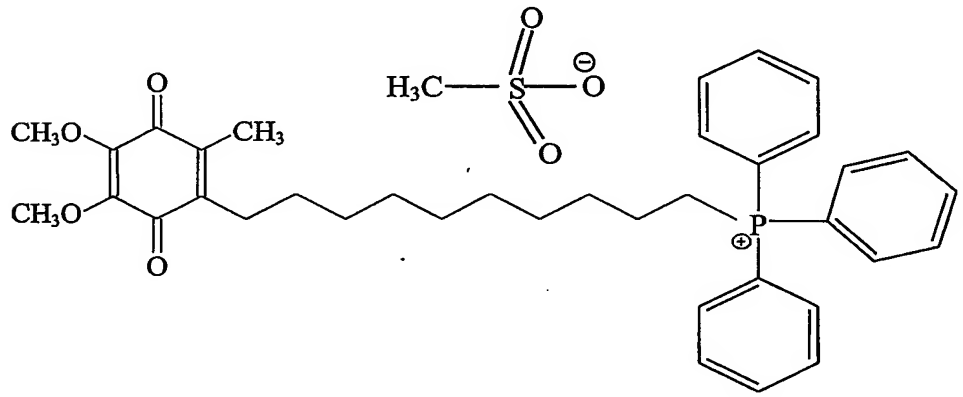
27. A composition according to any of claims 20 to 26 wherein the compound has the formula



(III).

28. A composition according to any of claims 11 to 27 wherein the cyclodextrin is β-cyclodrextrin.

29. A composition according to claim 28 wherein the compound has the formula



(III)

and the molar ratio of compound to cyclodextrin is about 1:2.

30. A composition according to any of claims 11 to 29 wherein the composition is formulated for oral administration.

31. A composition according to any of claims 11 to 29 wherein the composition is formulated for parenteral administration.

32. A dosage unit comprising or including a compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an

anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and the salt form is chemically stable and/or the anionic complement does not exhibit reactivity against the antioxidant moiety, the cationic moiety or the linking moiety, together with any pharmaceutically acceptable diluent and/or carrier and/or excipient.

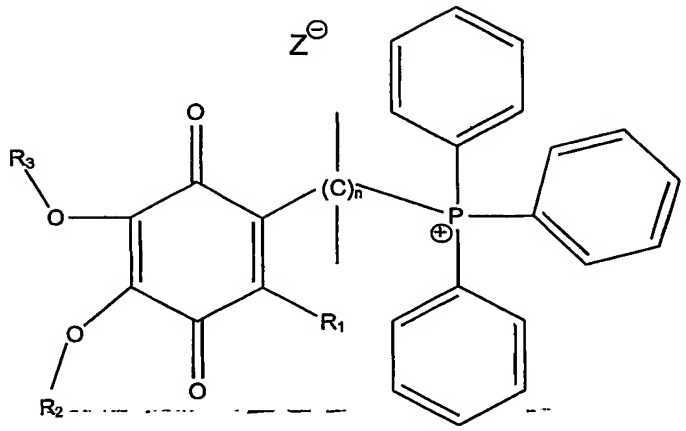
33. A dosage unit comprising or including a stable compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and wherein the anionic complement is not a halogen ion, and the anionic complement is non-nucleophilic and/or the anionic complement does not exhibit reactivity against the cationic moiety, the linking moiety, or the antioxidant moiety.

34. A dosage unit according to claim 32 or 33 wherein the antioxidant moiety is a quinone or a quinol.

35. A dosage unit according to claim 32 or 33 wherein the antioxidant moiety is selected from the group comprising vitamin E and vitamin E derivatives, chain breaking antioxidants, including butylated hydroxyanisole, butylated hydroxytoluene, general radical scavengers including derivatised fullerenes, spin traps including derivatives of 5,5-dimethylpyrroline-*N*-oxide, *tert*-butylnitrosobenzene, *tert*-nitrosobenzene, α-phenyl-*tert*-butylnitrone and related compounds.

36. A dosage unit according to any of claims 32 to 35 wherein the lipophilic cationic moiety is a substituted or an unsubstituted triphenylphosphonium cation.

37. A dosage unit according to claim 36 wherein the compound has the general formula I



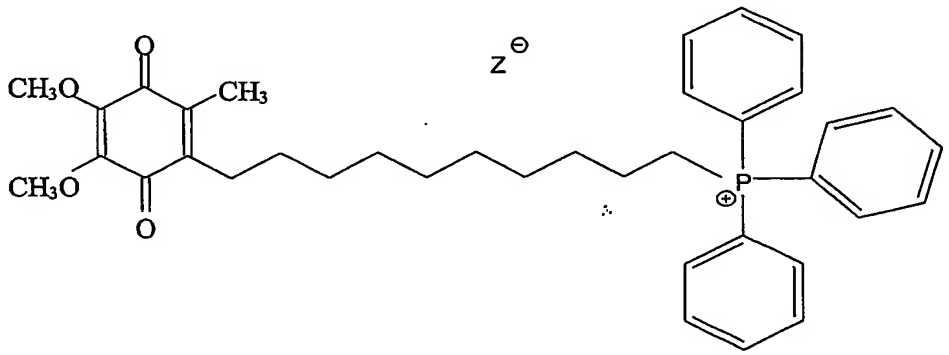
I

and/or its quinol form, wherein R_1, R_2, and R_3, which can be the same or different, are selected from C_1 to C_5 alkyl (optionally substituted) moieties or H, and wherein n is an integer from about 2 to 20, and wherein Z is a non-reactive anion.

38. A dosage unit according to claim 37 wherein Z is selected from the group consisting of alkyl or aryl sulfonates or nitrates.

39. A dosage unit according to claim 37 or claim 38 wherein C of the (C)n bridge is saturated.

40. A dosage unit according to claim 39 wherein the compound has the formula



II

and/or its quinol form, wherein Z is a non-nucleophilic anion.

41. A dosage unit according to any of claims 32 to 40 wherein the dosage unit comprises cyclodextrin.

42. A dosage unit according to claim 41 wherein the molar ratio of compound to cyclodextrin is from about 10:1 to about 1:10.

43. A dosage unit according to claim 42 wherein the molar ratio of compound to cyclodextrin is from about 5:1 to about 1:5.

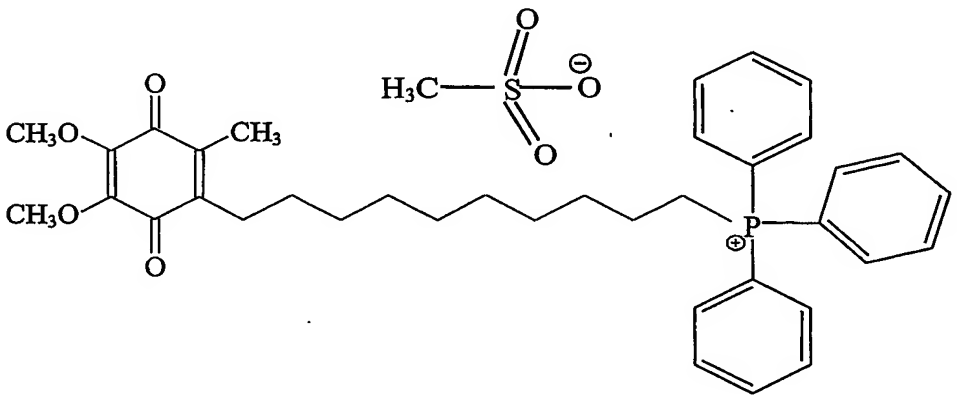
44. A dosage unit according to claim 43 wherein the molar ratio of compound to cyclodextrin is from about 4:1 to about 1:4

45 - A dosage unit according to claim 44 wherein the molar ratio of compound to cyclodextrin is from about 2:1 to about 1:2

46. A dosage unit according to claim 45 wherein the molar ratio of compound to cyclodextrin is about 1:1.

47. A dosage unit according to claim 45 wherein the molar ratio of compound to cyclodextrin is about 1:2.

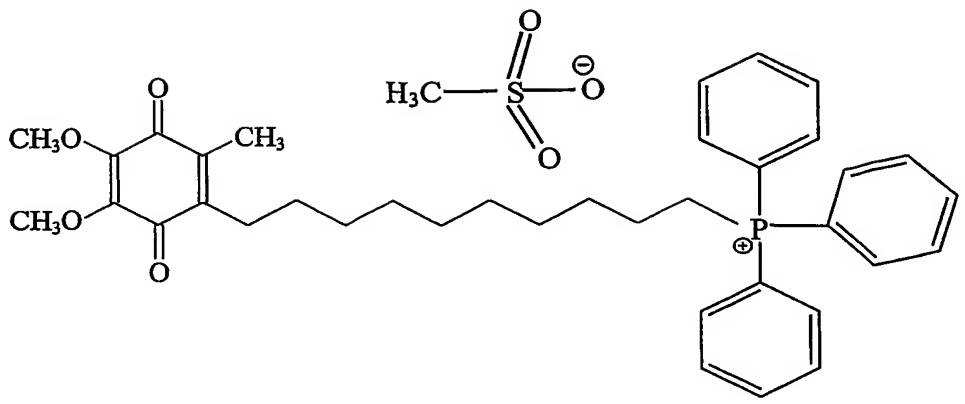
48. A dosage unit according to any of claims 40 to 47 wherein the compound has the formula



(III).

49. A dosage unit according to any of claims 41 to 48 wherein the cyclodextrin is β-cyclodrextrin.

50. A dosage unit according to claim 49 wherein the compound has the formula



(III)

and the molar ratio of compound to cyclodextrin is about 1:2.

51. A dosage unit according to any of claims 32 to 50 wherein the dosage unit is formulated for oral administration.

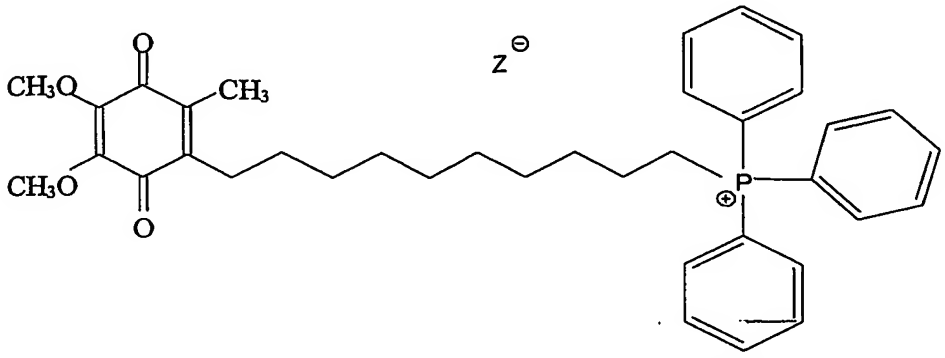
52. A dosage unit according to any of claims 32 to 50 wherein the dosage unit is formulated for parenteral administration.

53. A compound according to any of claims 1 to 10 or a pharmaceutically acceptable salt thereof for use in the prophylaxis or treatment of oxidative stress in a mammal by administration of the compound or the salt thereof to said mammal.

54. A compound according to any of claims 1 to 10 or a pharmaceutically acceptable salt thereof for use in the prophylaxis or treatment of symptoms of aging in a mammal by administration of the compound or the salt thereof to said mammal.

55. A compound or a pharmaceutically acceptable salt thereof according to claim 53 or 54 wherein said administration is on the first day at a dose of about 1.02 about 2.0 times the daily maintenance dose, followed by administration of the compound or the salt thereof at the daily maintenance dose of the subsequent days.

56. A compound or a pharmaceutically acceptable salt thereof according to any of claims 53 to 55 wherein said compound has the formula

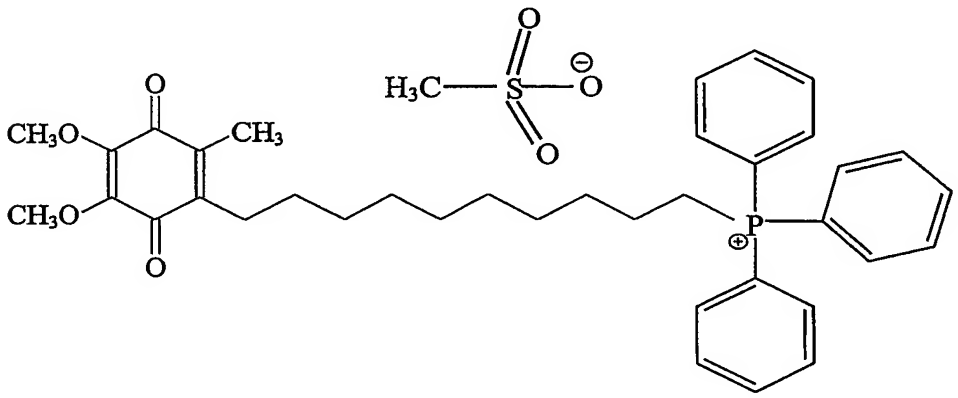


and/or its quinol form, wherein Z is a non-nucleophilic anion.

57. A compound or a pharmaceutically acceptable salt thereof according to any of claims 53 to 56 wherein the salt is that of the methanesulfonate.

58. A compound or a pharmaceutically acceptable salt thereof according to any of claims 53 to 56 wherein the compound is combined with cyclodextrin.

59. A compound according to claim 58 wherein the compound has the formula



(III)

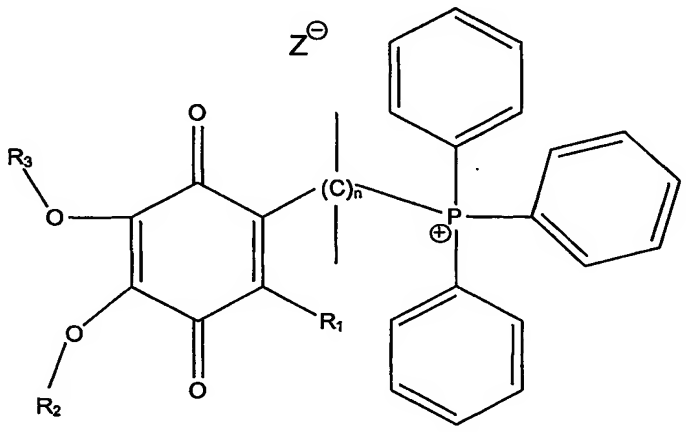
wherein the cyclodextrin is β-cyclodrextrin and the molar ratio of compound to cyclodextrin is about 1:2.

60. A dosage unit suitable for oral administration comprising as an active ingredient a compound according to any of claims 1 to 10, the compound being of or being formulated as a crystalline form and/or non-liquid form.

61. A dosage unit suitable for parenteral administration comprising as an active ingredient a compound according to any of claims 1 to 10.

62. A pharmaceutical composition suitable for treatment of a patient who would benefit from reduced oxidative stress or reduced symptoms of ageing which comprises or includes an effective amount of a compound according to any of claims 1 to 10 in combination with one or more pharmaceutically acceptable carriers, excipients, or diluents.

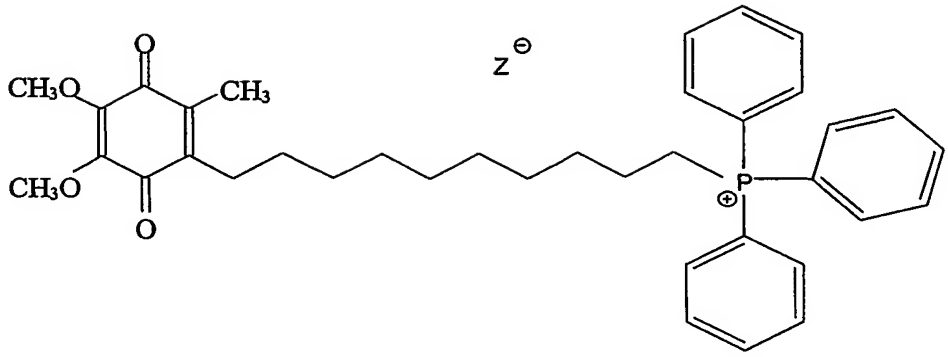
63. A composition according to claim 62 wherein the compound is a compound of formula I



I

and/or its quinol form, wherein R_1, R_2, and R_3, which can be the same or different, are selected from C_1 to C_5 alkyl (optionally substituted) moieties or H, and wherein n is an integer from about 2 to 20, and wherein Z is a non-reactive anion.

64. A composition according to claim 63 wherein the compound has the formula



II

and/or its quinol form, wherein Z is a non-nucleophilic anion.

65. A composition according to any of claims 62 to 64 wherein the composition comprises cyclodextrin.

66. A composition according to claim 65 wherein the molar ratio of compound to cyclodextrin is from about 10:1 to about 1:10.

67. A composition according to claim 66 wherein the molar ratio of compound to cyclodextrin is from about 5:1 to about 1:5.

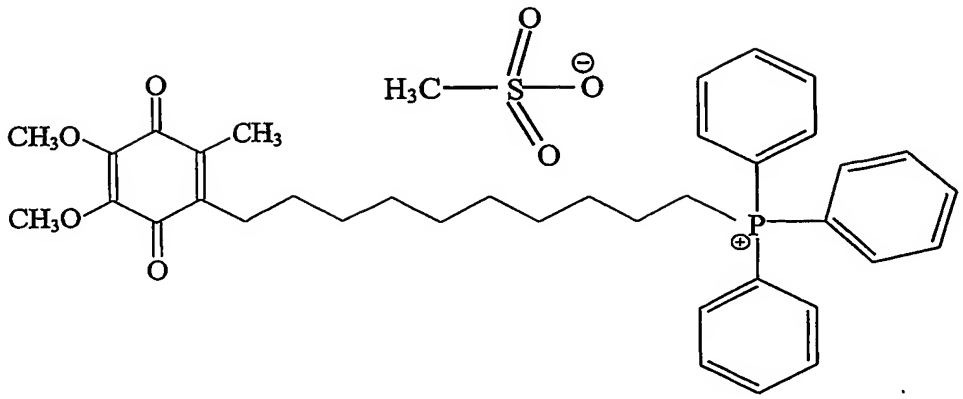
68. A composition according to claim 67 wherein the molar ratio of compound to cyclodextrin is from about 4:1 to about 1:4

69. A composition according to claim 68 wherein the molar ratio of compound to cyclodextrin is from about 2:1 to about 1:2

70. A composition according to claim 69 wherein the molar ratio of compound to cyclodextrin is about 1:1.

71. A composition according to claim 69 wherein the molar ratio of compound to cyclodextrin is about 1:2.

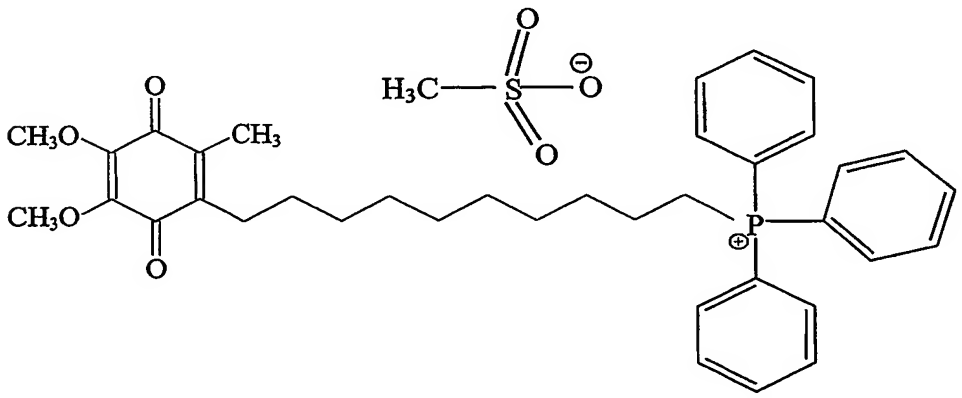
72. A composition according to any of claims 65 to 71 wherein the compound has the formula



(III).

73. A composition according to any of claims 65 to 72 wherein the cyclodextrin is β-cyclodrextrin.

74. A composition according to claim 73 wherein the compound has the formula



(III)

and the molar ratio of compound to cyclodextrin is about 1:2.

75. A composition according to any of claims 61 to 74 wherein the composition is formulated for oral administration.

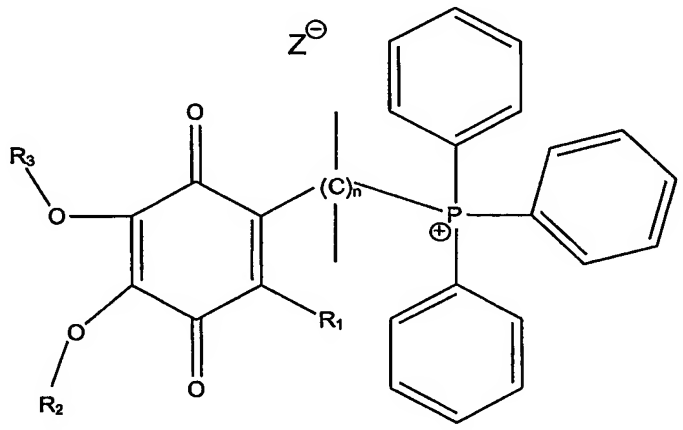
76. A composition according to any of claims 61 to 74 wherein the composition is formulated for parenteral administration.

77. A method of reducing oxidative stress in a cell which comprises the step of contacting said cell with a compound comprising a lipophilic cationic moiety

linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and the salt form is chemically stable and/or the anionic complement does not exhibit reactivity against the antioxidant moiety, the cationic moiety or the linking moiety.

78. A method of reducing oxidative stress in a cell which comprises the step of contacting said cell with a stable compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and wherein the anionic complement is not a halogen ion, and the anionic complement is non-nucleophilic and/or the anionic complement does not exhibit reactivity against the cationic moiety, the linking moiety, or the antioxidant moiety.

79. A method according to claim 77 or 78 wherein the compound is a compound of formula I



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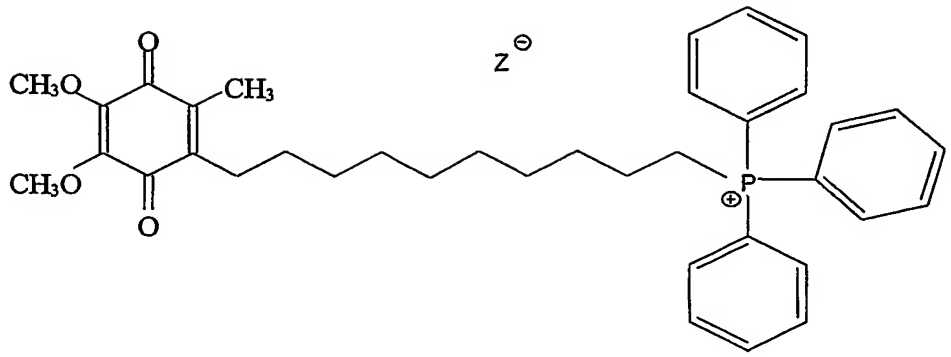
and/or its quinol form, wherein R_1, R_2, and R_3, which can be the same or different, are selected from C_1 to C_5 alkyl (optionally substituted) moieties or H, and wherein n is an integer from about 2 to 20, and wherein Z is a non-reactive anion.

80. A method according to claim 79 wherein the compound has the formula



II

and/or its quinol form, wherein Z is a non-nucleophilic anion.

81. A method according to any of claims 77 to 80 wherein the compound is complexed with cyclodextrin.

82. A method according to claim 81 wherein the molar ratio of compound to cyclodextrin is from about 10:1 to about 1:10.

83. A method according to claim 82 wherein the molar ratio of compound to cyclodextrin is from about 5:1 to about 1:5.

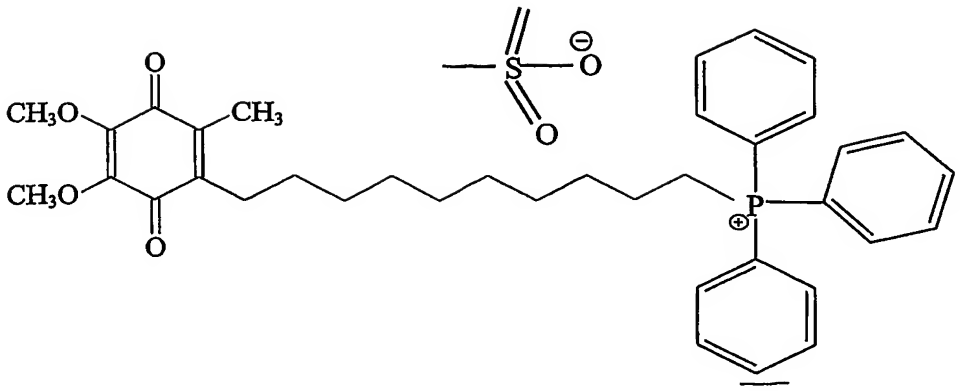
84. A method according to claim 83 wherein the molar ratio of compound to cyclodextrin is from about 4:1 to about 1:4

85. A method according to claim 84 wherein the molar ratio of compound to cyclodextrin is from about 2:1 to about 1:2

86. A method according to claim 85 wherein the molar ratio of compound to cyclodextrin is about 1:1.

87. A method according to claim 85 wherein the molar ratio of compound to cyclodextrin is about 1:2.

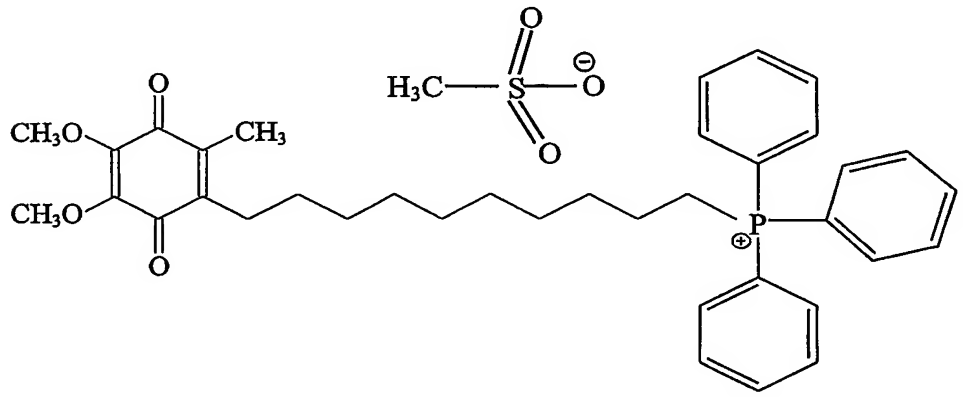
88. A method according to any of claims 81 to 87 wherein the compound has the formula



(III).

89. A method according to any of claims 81 to 88 wherein the cyclodextrin is β-cyclodrextrin.

90. A method according to claim 89 wherein the compound has the formula



(III)

and the molar ratio of compound to cyclodextrin is about 1:2.

91. A method of therapy or prophylaxis of a patient who would benefit from reduced oxidative stress and/or reduced symptoms of aging which comprises or includes the step of administering to said patient a compound, composition and/or dosage form wherein the compound is, or the composition or dosage form comprises, a compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an

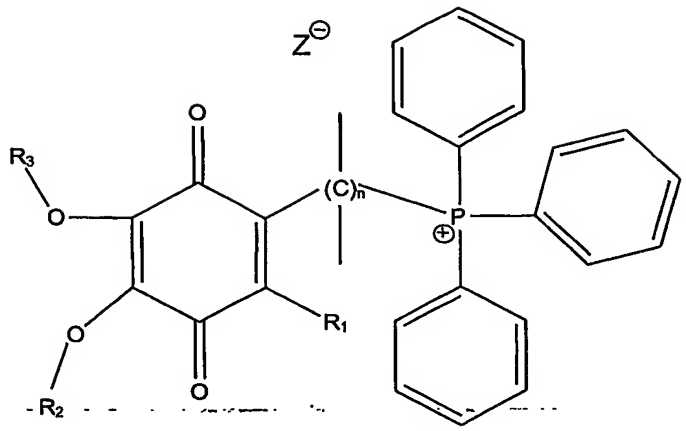
anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and the salt form is chemically stable and/or the anionic complement does not exhibit reactivity against the antioxidant moiety, the cationic moiety or the linking moiety.

92. A method of therapy or prophylaxis of a patient who would benefit from reduced oxidative stress and/or reduced symptoms of aging which comprises or includes the step of administering to said patient a compound, composition and/or dosage form wherein the compound is, or the composition or dosage form comprises, a stable compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and wherein the anionic complement is not a halogen ion, and the anionic complement is non-nucleophilic and/or the anionic complement does not exhibit reactivity against the cationic moiety, the linking moiety, or the antioxidant moiety.

93. A method according to claim 91 wherein the composition is a composition according to any of claims 11 to 31.

94. A method according to claim 91 wherein the dosage form is a dosage form according to any of claims 32 to 52.

95. A method according to claim 91 or 92 wherein the mitochondrially targeted antioxidant compound is a compound of formula I



I

and/or its quinol form, wherein R_1, R_2, and R_3, which can be the same or different, are selected from C_1 to C_5 alkyl (optionally substituted) moieties or H, and wherein n is an integer from about 2 to 20, and wherein Z is a non-reactive anion.

96. A method according to claim 95 wherein the compound is complexed with cyclodextrin.

97. A method according to claim 96 wherein the molar ratio of compound to cyclodextrin is from about 10:1 to about 1:10.

98. A method according to claim 97 wherein the molar ratio of compound to cyclodextrin is from about 5:1 to about 1:5.

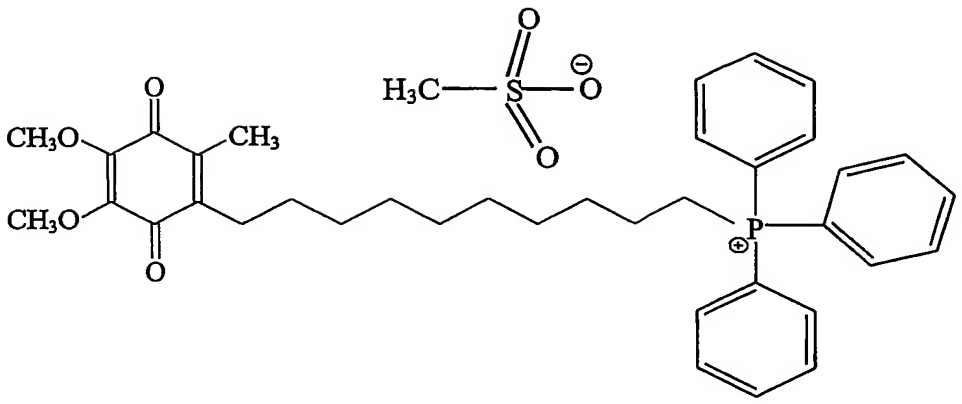
99. A method according to claim 98 wherein the molar ratio of compound to cyclodextrin is from about 4:1 to about 1:4

100. A method according to claim 99 wherein the molar ratio of compound to cyclodextrin is from about 2:1 to about 1:2

101. A method according to claim 100 wherein the molar ratio of compound to cyclodextrin is about 1:1.

102. A method according to claim 100 wherein the molar ratio of compound to cyclodextrin is about 1:2.

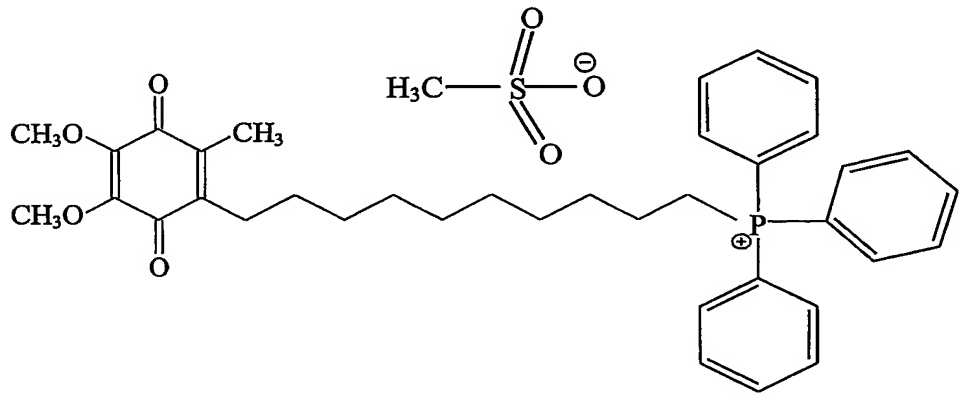
103. A method according to any of claims 95 to 102 wherein the compound has the formula



(III).

104. A method according to any of claims 95 to 103 wherein the cyclodextrin is β-cyclodrextrin.

105. A method according to claim 104 wherein the compound has the formula



(III)

and the molar ratio of compound to cyclodextrin is about 1:2.

106. A method according to any of claims 91 to 105 wherein said administration is oral administration.

107. A method according to any of claims 91 to 105 wherein said administration is parenteral administration.

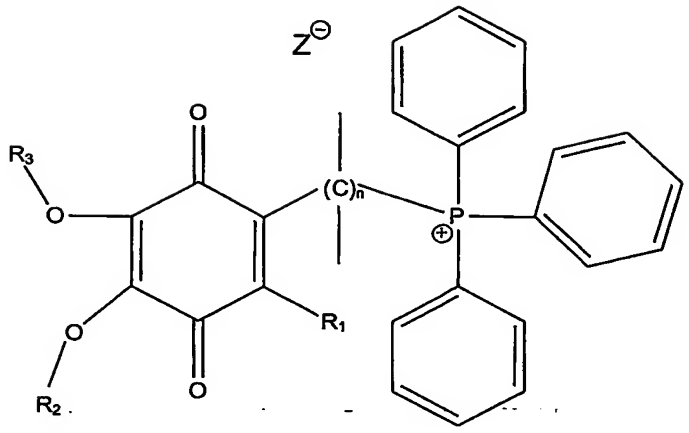
108. The use of a compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said

cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and the salt form is chemically stable and/or the anionic complement does not exhibit reactivity against the antioxidant moiety, the cationic moiety or the linking moiety in the preparation or manufacture of a medicament, dosage unit, or pharmaceutical composition effective for use in for the reduction of oxidative stress in a patient.

109. The use of a compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and the salt form is chemically stable and/or the anionic complement does not exhibit reactivity against the antioxidant moiety, the cationic moiety or the linking moiety in the preparation or manufacture with other material or materials of a medicament, dosage unit, or pharmaceutical composition effective for use for the reduction of symptoms of aging in a patient.

110. The use of a compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and the salt form is chemically stable and/or the anionic complement does not exhibit reactivity against the antioxidant moiety, the cationic moiety or the linking moiety in the preparation or manufacture of a composition effective for use in the reduction of oxidative stress in a cell.

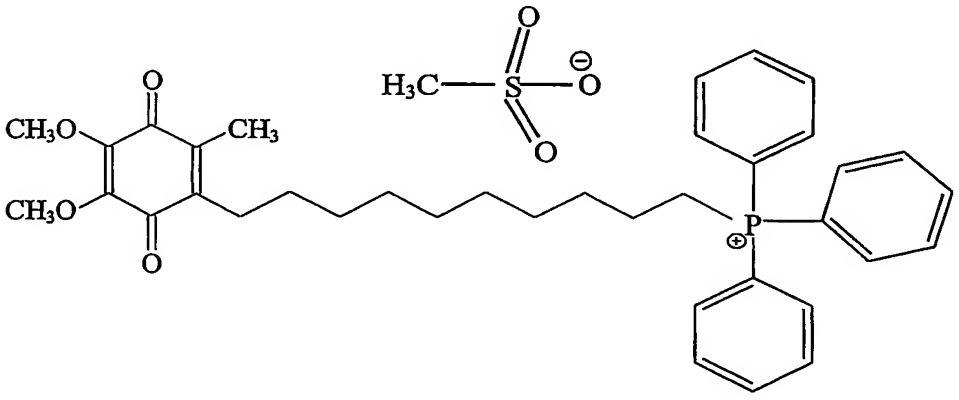
111. A method of synthesis of a compound of the formula I



I

(and/or its quinone form) wherein R_1, R_2, and R_3, which can be the same or different, are selected from C_1 to C_5 alkyl (optionally substituted) moieties, and wherein n is an integer from 2 to 20, said method including or comprising the admixture of cyclodextrin.

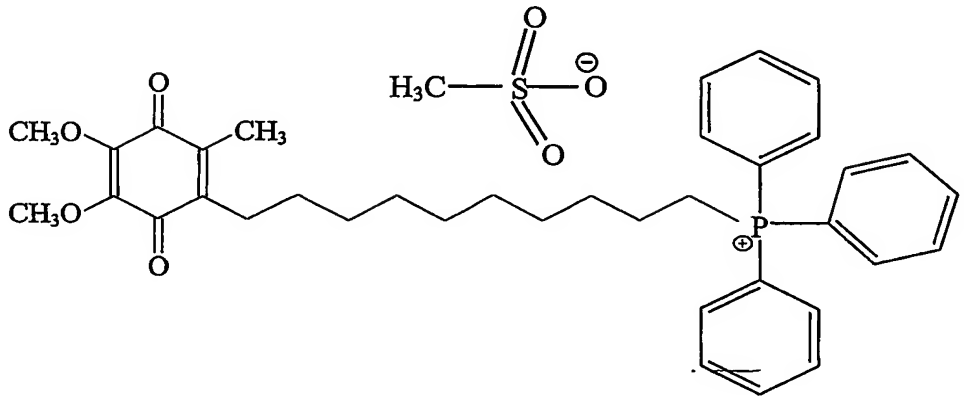
112. A method of synthesis of a compound having the formula



(III)

said method including or comprising the admixture of cyclodextrin.

113. A method of synthesis of a compound having the formula



(III)

essentially as herein described.

114. A pharmaceutical composition suitable for treatment of a patient suffering from or predisposed to Parkinson's disease, Alzheimer's disease, Huntington's Chorea, or Friedreich's Ataxia, which comprises or includes an effective amount of a compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and the salt form is chemically stable and/or the anionic complement does not exhibit reactivity against the antioxidant moiety, the cationic moiety or the linking moiety, in combination with one or more pharmaceutically acceptable carriers, excipients, or diluents.

115. A composition according to claim 114 suitable for treatment of a patient suffering from or predisposed to Friedreich's Ataxia.

116. A method of therapy or prophylaxis of a patient suffering from or predisposed to Parkinson's disease, Alzheimer's disease, Huntington's Chorea, or Friedreich's Ataxia which comprises or includes the step of administering to said patent a compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable

of mitochondrially targeting the antioxidant species, and the salt form is chemically stable and/or the anionic complement does not exhibit reactivity against the antioxidant moiety, the cationic moiety or the linking moiety.

117. A method according to claim 116 wherein said therapy or prophylaxis is of a patient suffering from or predisposed to Friedreich's Ataxia.

118. The use of a compound comprising a lipophilic cationic moiety linked by a linking moiety to an antioxidant moiety, and an anionic complement for said cationic moiety, wherein the cationic species is capable of mitochondrially targeting the antioxidant species, and the salt form is chemically stable and/or the anionic complement does not exhibit reactivity against the antioxidant moiety, the cationic moiety or the linking moiety, in the preparation or manufacture of a medicament, dosage unit, or pharmaceutical composition effective for use in the treatment or prophylaxis of a patient suffering from or predisposed to Parkinson's disease, Alzheimer's disease, Huntington's Chorea, or Friedreich's Ataxia.

119. The use according to claim 118 wherein the medicament, dosage unit, or pharmaceutical composition is effective for use in the treatment or prophylaxis of a patient suffering from or predisposed to Friedreich's Ataxia.